THE PRACTICAL PART OF ELECTRICAL HAULAGE.

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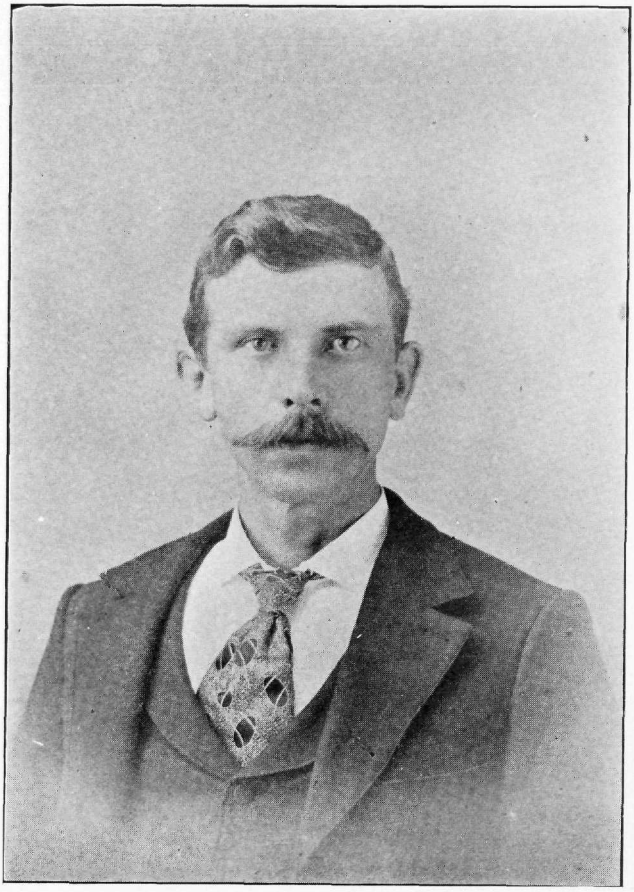
Mr. President and Gentlemen of the Institute:

At the request of the secretary, I have prepared a short paper, the subject of which is "The Practical Part of Electrical Haulage." Within the last ten years great strides have been made with the electric motor for hauling coal along the main roads of mines. While there have been failures in the use of this power, they have generally been due to the fact that persons who tried to apply it did not understand the requirement of the mine; yet to-day there is no doubt but that electric motors are as much a success in mines as they are along the streets of this city. Some nine or ten years ago, when electric cars were introduced in this city, many were in doubt as to their success. At that time electric motors were being tried in several mines of this country, and some doubted their success also; but the advanced state of machinery was such that when the electrician and machinist understood what was required for a good mine motor, they were not long in fulfilling the requirement. Probably there is no branch of science in which so many were interested, that has made such rapid strides as the electric power; hence it cannot be expected that every one should be acquainted with its use. And as it is destined to play such an important part as a haulage system in mines, I concluded that a short paper on its practical part, as applied to mines, would be of interest to many; while to others who have had practical experience, this is not intended. The first thing to be decided upon the introduction of electric haulage, is the weight of the motor needed, as this is one of the most important points. But how are the mining engineer and mine manager to know this? First, he must first find out about the maximum grade he expects to maintain in his mine. While this cannot always be ascertained, yet it can be approximately, only in exceptional cases.



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It is not always safe to depend upon the advice of the maker or his agent on the weight of motor to be used, as they are anxious to sell and may advise a lighter motor in order to reduce the first cost of installing the plant. After deciding the maximum grade, the distance the coal must be hauled, and the amount to be hauled, by comparing with some other motor in use, a fair judgment can be formed as to the weight of motor required. I have found that a ten-ton motor, traveling at the rate of six or eight miles per hour, can haul eighteen loaded cars weighing 1300 pounds each, with 4000 pounds of coal, up a two per cent. grade, if the cars are in fair condition, with 16-inch wheel and kept well oiled. After deciding on the weight of the motor, the next thing will be the size of rail needed. A 25-pound rail for 7½-ton, and 30-pound rail for a 10-ton motor, will make good tracks. The tracks should be kept as dry as possible. When it is very difficult to keep them dry and where the bottom is soft, it can be expected there will be much trouble with the track, and I do not believe it would be a desirable system under these circumstances. Curves should be made of as long radii as possible, yet it is surprising on what short curves they can be worked. The track is an important thing and care should be taken in laying it. On short curves guard rails should be used; and also, opposite the frogs. Try and not have a curve to exceed 25-foot radius. A good rule is to lay a straight edge ten feet long against the inner side of the top of the outer rail, then measure from the five-foot mark of the straight edge to the inner side of the rail. This distance should not exceed six inches. The height of outer rail should be measured with the 10-foot straight edge, as given in the above rule, and one-third of the distance to the rail makes a good height for the outer rail. Stub or point switches can be used with equal success. A motor for a 42-inch guage track should be built 41¼ inches inside of flanges, which will give a wider wearing surface to the tire and a much longer use.

The next in order will be the location of the surface machinery. Locate the boiler near the engine, so as to have as dry steam as possible. The pressure should be kept up to the engine builder's limit. Locate the dynamo in a dry place. Build good foundations for both engine and dynamo, as it is not so much the pull as the vibration, and for high speed machinery a solid foundation is important. Do not cut the bolts shorter than the maker sends them. If you build the foundation of brick, a good way is to dig a hole of the required size down to hard ground; then lay brick in cement and grout every other

course, building solid against the side of the ground to the surface, then tapering to suit the machinery. It is important that everything be kept clean in the dynamo room and no loafing should be allowed there. The dynamo should have a quarter more power than the motor.

CONDUCTORS.

If the mine is a drift, the work of wiring will be simple. If a shaft, use insulated wire to the bottom; usually the air shaft is used. If the shaft is wet run the wires through a pipe hung in the shaft. If the wire is to be carried down a drill hole or the shaft be deep, much more care should be taken, using wire that is well insulated and has a lead covering. Along the hauling road, some means of supporting the hangers must be used. A good way when the roof is suitable is to drill two holes about two inches in diamater, ten inches deep and one foot apart, crosswise over one of the rails; then drive wooden plugs in the holes. As it is important to have the hangers of uniform height above the rails, the plugs should be long enough to allow them to be sawed off at the proper height above the rails, then nail a piece of wood 1½ by 4 by 14 inches on to the ends of the plugs, using about three 20-penny spikes to each plug. This gives a good support for the hangers and will give no trouble afterwards. Where the roof will not admit of this, use cross bars across the entry. Plugs driven in the sides and extending out over the rail is another plan, but is not so good and will give more or less trouble. The hangers should be about 30 feet apart, except on curves. In stretching the wire, one end should be fastened to an insulated turnbuckle. As the wire should be stretched very taut, the writer has found a pair of chain blocks to be the best for this purpose. Two or three men can pull the wire tight enough and the blocks will hold without any difficulty. The wire should be pounded with pieces of wood in order to get all kinks out; then another pull made of the chain blocks; then after closing the ears, the blocks are moved on about 100 or more feet and the same thing repeated. In order to get something to fasten the blocks to, take a piece of timber longer than the height of the entry, dig a hole in the roof, set one end of the timber up in it, and the other end resting on the floor causes it to stand in a slanting position. This is quickly done and gives a good brace.

BONDING THE RAILS.

As there are different kinds of bonds for the joints, if a bond is to be used that requires a bond hole in the rail, it will save

much labor to purchase rails that have bond holes in them. Some mines bond the rails by using a No. 5 wire and winding it around the bolts before the fish plate is put on, and report it very satisfactory. Cross bonds should be used every 100 feet or so, for fear a bond should break at some joint. If there are any pipe lines running parallel to the hauling road, bond to them every two or three hundred feet. Some trouble may be experienced at first in soldering to the pipe.

Remove the rust from the pipe with a file until it becomes bright, and then solder a piece of wire to the bright place on the pipe, also the other end of wire. Solder to a bond on the rail. Water pipes are good conductors. The writer never thinks of using a double line of wire in conducting power to a mining machine where there is a pipe line.

CARS.

The mine cars should be kept in good running order. It will require more repair work on cars than when hauling with horses. Use center bumpers, and be careful and not get them too round, so the cars can be pushed as well as pulled. Pin and link are about the best coupling.

MOTORMAN.

The motorman should be a fearless but careful man, should know something about the care of the motor, should keep it clean, should be on the watch for burnt places, should see that the brushes are kept at proper tension, and he must always be on the alert to prevent loss of time by permitting the motor to stop. He should learn to run his motor backward for short distances without changing the trolley, or he will lose much time in switching. He should change his fuse wire occasionally and should not increase the size of fuse wire sent by the maker. If he does, it will not be long before there are burnt out armatures. He should be careful about the use of sand; this being in insulator, it is possible to get so much on the track that it will insulate the motor entirely. A motor should be able to handle its load with good speed. It is bad policy to overload it.

DANGER.

Some may object to using electric power in mines giving off any fire damp. When naked lights are used there should be no fear on this point, as there is no danger where 250 volts are used. How much higher voltage can be used with safety, the writer cannot tell.

SIDINGS.

Some places use three tracks at their inside or gathering switches; unless very long trains are used this is not needed. By a little practice, running switches can be made that would surprise any one not acquainted with the system. This leaves the motor ready to start out with loaded trip by the time the empties have run in on the siding. If the motor has any spare time it should be used at the shaft bottom, or at the hoppers to block down trains, thereby saving much labor. Longer sidings are required than with horses. At the hoppers, if a drift mine, or at the bottom, if a shaft, three tracks should be used, as it would be too much risk and a loss of time to dumpers or cagers to make running switches. It should be arranged so the motor will come as near the hopper or shaft bottom as possible. This can be done by having a track passing the side of the shaft and a track leading back off to one side. By this plan coal can be hauled with the same motor from both sides of the shaft. The motor can also bring the train close to the shaft, and so doing save much labor.

The old Proverb: "A stitch in time will save nine," was never more applicable than in the use of electric power. What may be a small matter to-day, that would only require a few minutes to make right, to-morrow may be serious and cause delay for hours. Every person in charge of a motor should be educated to understand this, and be held responsible to a reasonable degree for the care of the motor. The old slash and bang policy, that has been practiced so much in mines, will prove a failure with this power. Nothing beats well-directed energy.

By observing the foregoing, there is no reason why any one can not have a haulage that will give satisfaction. The writer has had opportunity to observe steam locomotive haulage, rope haulage and electric haulage, and prefers the latter for health of employes, adaptability and least care.

MR. LAVIERS: Have you ever had any experience with channel iron?

MR. THOMAS: I was engineer at the Powell mine at Shawnee at the time they put in electric haulage there, and they used the channel bar system, and later the pipe system instead of the channel bar.

MR. LAVIERS: What I have reference to is in the shape of the figure eight,—a hole is drilled and clamps one side of the figure eight and leaves the other exposed to the trolley.

MR. THOMAS: I was speaking to an electrician and he told me about that wire in Number Two mine. He says it is all right and will adopt it hereafter.

MR. COXE: I would like to ask if that style of wire is not much harder to handle, to string the mine with, than round wire?

MR. THOMAS: I could not say from experience, but I think it could be hung without trouble.

MR. LAVIERS: One mine in our company had such a wire put in.

MR. THOMAS: How is that fastened to the side?

MR. LAVIERS: It was explained to me that they bore a hole in the side same as in the roof, and the hanger is driven in and clamps onto one-half of the wire and leaves the other half in that shape (indicating) for the trolley to catch to. I think if the trolley keeps it as well as the overhead wire, in some mines it would be the best.

MR. PALMROS: I think, Mr. Chairman, speaking about side running trolley, the first manufacturing company to introduce the side trolley was in Iron Point, this state. The wire is a symmetrical figure eight, clamped with a spring on one side. The trolley pole consists of two poles, moving equally, and joined at the upper and lower ends. At the upper end the cross piece is upright where the trolley wheel rotates instead of vertically across, supported by springs. Prices are against this wire. This trolley has many good features, among the best being that whenever the trolley leaves the wire, instead of flying up to the roof and tearing it to pieces, drops right down out of harm. It is easy to reach, and this trolley was invented by myself and the patents, I think, are granted by this time.

PRESIDENT RAY: It will be necessary to be brief with these discussions if we desire to finish the program this afternoon. If there is no objection, we will pass to the next number.

MR. LOVE: I desire that a vote of thanks be extended to Mr. Thomas for his paper, and make a motion to that effect.

(Seconded; carried.)